

Parkinsonism

Early Results of Occlusion of the Anterior Choroidal Artery

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IN 1817 DR. JAMES PARKINSON⁷ optimistically stated, "There appears to be sufficient reason for hoping that some remedial process may ere long be discovered by which, at least, the progress of the disease may be stopped." And yet 137 years later it is obvious that this status has not been achieved either by medical or surgical means. Sir Victor Horsley^{5, 6} introduced the first surgical procedure for Parkinsonism in 1890 and published his final studies in 1909. The cortical excision of the motor area and subsequent modifications of the operation have for the most part been unsatisfactory because of the resultant spastic hemiplegia or hemiparesis following section or removal of some part of the so-called "pyramidal system."

In April 1953 Cooper³ reported dramatic amelioration of Parkinsonism by ligation of the anterior choroidal artery in two severely advanced cases. The following August,⁴ in a brief report of six cases, he described "striking alleviation of Parkinsonian tremor at rest," and added that "the procedure has been invariably followed by disappearance of most of the rigidity and cogwheelism from the contralateral extremities." Hemiplegia or hemianesthesia did not occur.

A brief review of the blood supply of the anterior choroidal artery, as outlined by Abbie¹ in 1936, and by Alexander² in 1942, might be of interest. The artery, which has been called the "pallidohippocampocapsular artery,"² supplies some of the areas affected pathologically by Parkinson's disease of idiopathic, arteriosclerotic, or postencephalitic type. In general the following areas of the brain are irrigated: (1) the globus pallidus, (2) the ventral part of the posterior limb and the retrolenticular portion of the internal capsule, (3) the middle third of the basis pedunculi and superficial adjacent portions of the dorsal thalamus and subthalamus, (4) the hippocampal formation and surrounding structures, (5) portions of the optic tract and lateral geniculate

• Occlusion of the anterior choroidal artery was carried out in four cases for relief of Parkinsonism. Results were disappointing but there was temporary cessation of tremor in three cases and sustained alleviation of rigidity in two cases.

The causes of these changes following operation are unknown.

body and (6) the choroid plexus of the lateral ventricle.

The present communication is a preliminary report of experience with four cases in which surgical occlusion of the anterior choroidal artery was done. The operative procedure was performed bilaterally in one case and unilaterally in three. There were no immediate postoperative fatalities. One patient, however, died of tuberculous pneumonia six weeks postoperatively. The operative technique was similar in all instances. Temporal craniotomy was performed opposite to the affected side of the body. After the temporal lobe was elevated intradurally and the interpeduncular cistern was opened, the anterior choroidal artery was identified arising from the internal carotid artery above the posterior communicating artery. Silver clips were placed upon the anterior choroidal artery just distal to its origin. In addition, the arteries were coagulated, except in the first case.

REPORTS OF CASES

CASE 1. The patient was a 59-year-old right-handed man with postencephalitic Parkinson's syndrome of 24 years' duration, demonstrated in preoperative neurological examinations. There were severe alternating tremors in the upper extremities, generalized rigidity, cogwheel phenomena and other signs of advanced Parkinsonism. The patient was unable to walk and barely able to stand with support. After occlusion of the right anterior choroidal artery on November 24, 1953, no discernible change of the neurologic picture occurred except with regard to symptoms of paralysis agitans.

During the first three postoperative days the tremor on the left was periodically absent and, when

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present, was strikingly reduced compared to that on the right. The tremor of the left hand gradually returned to its preoperative magnitude, although at times it would be totally absent. The alternating tremor of the right hand continued unchanged postoperatively. The rigidity, cogwheel phenomena, posture, drooling, and other associated symptoms apparently were not influenced by the surgical procedure. The tremor was severe bilaterally during the two weeks of terminal illness, except for brief periods when it decreased on the left side. The patient died of tuberculous pneumonia.

Upon postmortem examination it was noted that the silver clip mechanically occluding the right anterior choroidal artery was in place. The only gross change noted apparently due to the procedure was some cerebral swelling, particularly in the region of the pallidum; in addition there was a small area of contusion over the inferior surface of the right temporal lobe probably due to operative exposure. There was no other gross softening of cerebral tissue. The substantia nigra showed bilateral symmetrical degeneration which apparently was a result of the disease process.

CASE 2. A 46-year-old right-handed man with post-encephalitic Parkinson's syndrome of 26 years' duration had advanced generalized severe muscular rigidity as a major problem. In addition he had mild tremor of the lower extremities and some tremor in the upper extremities. The patient could barely walk. Occlusion of the right anterior choroidal artery was performed on November 30, 1953, followed by occlusion of the left anterior choroidal artery on January 12, 1954. The status of the patient at the time this report was written, some two months after the second operation, was somewhat worse than it was preoperatively, but he was gaining strength. The final visual fields showed no defect although they remained constricted. The progression of Parkinsonism may have been somewhat accelerated by the stress from operation. There was no essential overall improvement of any symptoms. The rigidity in the left upper extremity apparently caused further flexion attitude of the elbow, wrist, and fingers.

CASE 3. The patient, a 60-year-old right-handed man, had had unilateral idiopathic Parkinson's syndrome for nine years. He walked with a hemiparetic attitude, striking the ball of the right foot, which was inverted and flexed. The weakness of the right extremities was mild, being most pronounced distally in the fingers and toes. The gripping pressure of the right hand was 25 pounds; of the left, 90 pounds. The movements of the right hand and foot were moderately stiff. There was moderate cogwheelism and rigidity in the right upper extremity and mild cogwheelism and rigidity in the right lower extremity. The alternating tremor was moderately severe and limited to the right hand and arm. It disappeared during volitional action and sleep. There were no other significant findings except for a slight central weakness of the right side of the face, and glove and stocking type of hypesthesia and hypalge-

sia and some decrease of vibration sense on the right. Following occlusion of the left anterior choroidal artery on Feb. 2, 1954, no essential change occurred in the tremor but a remarkable and, thus far, lasting disappearance of rigidity and cogwheel phenomena resulted. The patient walked with an improved gait, no longer striking the ball of the right foot; and he was able to evert and dorsiflex the foot with greater ease. The gripping pressure in the right hand increased to 70 pounds; it was 80 pounds for the left. The strength of the muscle groups of the right extremity was greatly improved. Postoperatively a moderate degree of anomia developed; but at the time of this report it was steadily disappearing.

CASE 4. A 44-year-old right-handed man had unilateral Parkinsonism of 30 years' duration manifested mainly by alternating tremor at rest confined to the right extremities with mild cogwheelism on the same side. In addition, there was evidence of mild pyramidal tract involvement in the right extremities. The left anterior choroidal artery was occluded on April 1, 1954, and, although for the first 24 hours postoperatively the tremor completely disappeared, it gradually returned within a week to almost its preoperative intensity and remained so.

DISCUSSION

The operative results in these four cases were disappointing. However, there can be little doubt that acute occlusion of the anterior choroidal artery resulted in immediate, although temporary, cessation of tremor in Cases 1, 2, and 4. Although rigidity was relatively unaffected in Case 2, continued alleviation of rigidity is an outstanding feature of Cases 3 and 4. It is believed that craniotomy per se did not influence these changes in the Parkinsonian syndrome of these patients. The explanation for the changes of tremor and rigidity is unknown but probably is related to ischemia and hypoxia of the globus pallidus, resulting in functional loss of its afferent and efferent systems. Pathologic studies of Case 1, which are not yet complete, may substantiate this thesis.

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The authors are to be congratulated for this careful and detailed work on occlusion of the anterior choroidal artery. It is only by such contributions that a new operative procedure such as this can be evaluated.

We have done this operation in one case. The patient, a man, age 59, was subject to tremor and rigidity of the right upper extremity which had begun ten years previously. He was operated upon nine months ago and has been free from the tremor and rigidity since then. The procedure resulted in what gross tests indicate to be incomplete homonymous hemianopia, although perimetric studies show it to be complete homonymous hemianopia. We are a little surprised that the patient is very well pleased despite the visual defect. It is interesting to note that in Case 3 in the foregoing report the patient regarded the results as quite satisfactory because of relief from the rigidity and weakness although the tremor persisted.

Our case and the second case in the foregoing report, both showing postoperative visual field defect, demonstrate that even though there is collateral circulation, it is not always adequate to maintain sufficient irrigation for regions of the brain not intended to be deprived of blood supply by the occlusion. This raises the question of variation in the vascular pattern or diminished collateral circulation. One is reluctant to carry out angiography in older patients and such a critical procedure as occlusion of the anterior choroidal artery is far more hazardous than angiography.

Failure to obtain uniform results from the operation indicate there is variation in the specific pathologic changes of Parkinsonism, or there is variation in the vascular pattern and anastomoses. It is common knowledge that the configuration of the circle of Willis very often does not conform to what we regard as the normal pattern. Similarly, one may reasonably expect variation in the anterior choroidal artery. In Case 4 in the foregoing report it was noted that this artery was much smaller than in the other three cases. One must assume that that patient had either an accessory anterior choroidal artery or that the areas usually supplied by the anterior choroidal artery were in that case supplied by branches from other arteries. This variability of the vascular pattern not only makes for failure of the procedure to control the rigidity and involuntary movements of Parkinsonism, but also allows unintended important neurologic deficit to result in those cases of inadequate collateral circulation or in instances in which the anterior choroidal artery irrigates more than the usual amount of tissue.

These experiences serve as a warning that occlusion of the anterior choroidal artery is not a procedure that can be offered without reservation to patients with Parkinsonism. It would be most unfortunate if patients with this distressing condition would gain the belief that by means of a simple operation they could obtain relief. It should be emphasized that the operation is most certainly a major surgical procedure, with the possibility of serious or disastrous complications, and that even if these complications are avoided, the procedure does not guarantee relief from Parkinsonism.